

**TECHNICAL MEMORANDUM NO. 1
CALIFORNIA URBAN WATER AGENCIES
STUDY OF DRINKING WATER QUALITY IN DELTA TRIBUTARIES**

July 21, 1993

Draft Technical Memorandum (TM) No. 1 was prepared as background information for the Project Advisory Committee (PAC) members for the July 14, 1993 PAC meeting. The memorandum has been revised to incorporate PAC comments on management alternatives, contaminant sources, and contaminants of concern received at the July 14, 1993 meeting.

Our proposed approach to this study differs slightly from the scope of work presented in the Invitation for Proposal. Rather than waiting until Phase 2 to identify potential management alternatives for improving Delta tributary drinking water quality, we propose to identify potential management alternatives early in the study. We believe this will quickly focus attention on gathering and evaluating meaningful data pertinent to the possible management alternatives.

This TM expands on the management alternatives discussed in the Brown and Caldwell (BC) proposal to conduct this study. This expansion consists of relating the contaminant sources, contaminants of concern, existing monitoring programs, and desired sampling locations to the management alternatives and also identifying hydrologic, seasonal, and other issues relevant to the alternatives.

POTENTIAL MANAGEMENT ALTERNATIVES

A number of potential management alternatives were identified by the BC project team based on past experience with Delta and Delta tributary water quality studies. We requested that the PAC members review the management alternatives we had identified and bring any additional ideas to the PAC meeting. The alternatives were discussed at the PAC meeting and consensus was reached on the preliminary list of alternatives. These preliminary alternatives are intended to guide the data collection and evaluation efforts. After collecting the data and evaluating the impacts on drinking water quality, the list of alternatives will be revisited and discussed with the PAC. If the Phase 2 work is authorized, the final list of alternatives generated jointly with the PAC will be evaluated.

1. Rerouting Sacramento River Agricultural Drainage to Yolo Bypass or the Toe Drain.

Rationale--The Colusa Basin Drain carries approximately 30 percent and Sacramento Slough contributes 60 percent of the agricultural drainage discharged to the Sacramento River upstream of Verona. Rerouting this drainage could potentially improve drinking water quality at most of the Sacramento River and

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Delta benchmark locations (Clifton Court, Tracy Pumping Plant, Sacramento River at Greene's Landing, Sacramento River at Verona).

Contaminant Source--Agricultural drainage upstream of the Delta.

Contaminants of Concern--Disinfection by-product (DBP) precursors, total organic carbon (TOC), ultra violet light ₂₅₄ (UV₂₅₄) microbiological contaminants, nutrients, arsenic, total dissolved solids (TDS), herbicides, and pesticides.

Existing Monitoring Programs--

- A. Central Valley Regional Water Quality Control Board (Regional Board), U.S. Geological Survey (USGS) and Department of Fish and Game studies on the Colusa Basin Drain.
- B. Department of Water Resources (DWR) data on Natomas East Main Drainage Canal.

Desired Monitoring Locations--

- A. Sacramento River upstream of Colusa Basin Drain discharge (upstream of Feather River confluence).
- B. Colusa Basin Drain and/or Sacramento Slough.
- C. Sacramento River at Verona.

Related Issues--

- A. Impact in the south Delta. The Yolo Bypass and Toe Drain discharge to sloughs which discharge to the Sacramento River just above Rio Vista and below the Delta Cross Channel. Water moving through the east Delta to the south Delta pumps will not contain any of the Toe Drain/Yolo Bypass discharge. Some percentage of the Yolo Bypass or Toe Drain discharge, however, will be diverted around the west Delta to the south Delta as a result of flow reversal of the San Joaquin River and entrainment through Georgiana Slough. This needs to be taken into account in terms of estimating load reductions at the Banks Pumping Plant.
- B. Impact in the north Delta. The Lindsey and Barker Slough system, which provides water to the North Bay Aqueduct pumping station, is in the pathway of the Yolo Bypass and Toe Drain. Currently, some percentage of the Yolo Bypass and Toe Drain discharges mixes with the North Bay Aqueduct source water. Increased loads at the North Bay Pumping Plant from the Yolo Bypass/Toe Drain alternative need to be evaluated and measures to reduce or eliminate mixing of the Yolo Bypass discharge with the North Bay source water will need to be considered.

- C. Seasonal issues. Colusa Basin Drain and Sacramento Slough flows vary seasonally - both with the rain year season and with the irrigation season. Yolo Bypass operates during the rain season. Toe Drain carries dry season discharges. Seasonal flow patterns will need to be included in the evaluation of this alternative.
- D. Water rights. The effect on water rights of downstream users will have to be examined.
- E. Effect on winter run salmon. The Yolo Bypass is a winter run salmon migratory route. The Department of Fish and Game has expressed concerns about temperature effects on the salmon in the Yolo Bypass.

2. **Diverting the Sacramento Regional Wastewater Treatment Plant (SRWTP) Effluent.**

Rationale--The SRWTP currently discharges 150 million gallons per day (mgd) of secondary treated effluent to the Sacramento River and has a design capacity of 181 mgd. One possible method of improving the drinking water quality of the Sacramento River at Greene's Landing is to divert the SRWTP effluent further downstream in the Sacramento River below the Delta Cross Channel. Upgrading the treatment plant to a tertiary plant is another possible method of improving drinking water quality. Another potential alternative is to completely remove the effluent from the Sacramento River by diverting it to a wetlands treatment area or reclamation facility. Sacramento Regional County Sanitation District is currently studying this second alternative. Sacramento County Wastewater Reclamation Study scoping sessions have indicated agricultural use of reclaimed wastewater in the southern part of the County offers the best reclamation opportunities. A 5 mgd filtration plant is currently under design to treat wastewater effluent which will be used for landscape irrigation. Additionally, a demonstration wetlands is under construction which will use 1 mgd of treated wastewater effluent. The intent is to have the wetlands discharge to Laguna Creek and Stone Lakes Wildlife Refuge. Some reclaimed wastewater from the wetlands may eventually reach the Delta.

Contaminant source--Wastewater discharge.

Contaminants of Concern--DBP precursors, UV₂₅₄ microbiological contaminants, nutrients, arsenic, and TDS.

Existing Monitoring Programs--

- A. Sacramento Coordinated Monitoring Program.
- B. Sacramento Regional Wastewater Treatment Plant Effluent and Receiving Water Quality Assessment.

Desired Monitoring Locations--

- A. Upstream of Freeport on the Sacramento River.
- B. SRWTP effluent.
- C. Downstream of Freeport on the Sacramento River.
- D. Sacramento River at Greene's Landing.

Related Issues--

- A. Impact in the South Delta. Water moving through the Delta Cross Channel to the south Delta pumps will not contain SRWTP effluent if the effluent is discharged to the Sacramento River downstream of the Cross Channel. Some percentage of the effluent, however, will be diverted around the west Delta to the south Delta. This needs to be taken into account in terms of estimating load reductions at the Banks Pumping Plant.
- B. SRWTP has had problems with the dechlorination system due to the length of their effluent pipeline (2 miles). Increasing the length of the pipeline may aggravate those problems.
- C. This alternative should be discussed with the State Water Resources Control Board's Water Rights Division.

4. Best Management Practices to Improve Urban Runoff Quality.

*Rationale--*Urban runoff from the Sacramento urban area is currently regulated by a National Pollutant Discharge Elimination System (NPDES) Permit. As a permit compliance measure, Sacramento is developing and implementing best management practices (BMPs) to reduce urban runoff pollutant loads and mitigate the effect of continued development. There is concern that the effects of urban runoff BMPs may not be measurable. After much discussion at the PAC meeting, it was decided that this alternative would be assessed by doing a sensitivity analysis to determine the effect of removing 100 and 50 percent of the urban runoff load of contaminants.

*Contaminant Source--*Urban runoff.

*Contaminants of Concern--*Coliforms, other microbiological contaminants, total suspended solids (TSS), nutrients, TDS, arsenic, DBP precursors, UV₂₅₄.

Existing monitoring programs--

- A. Sacramento Stormwater NPDES Compliance Monitoring Program

Desired Monitoring Locations--

- A. Sacramento River at Verona.
- B. Sacramento River upstream of Sacramento.
- C. Sacramento storm drain discharges.
- D. Sacramento River downstream of Sacramento.
- E. Sacramento River at Greene's Landing.

Related Issues--

- A. Ability to measure reductions in existing discharges. The ability to measure reductions in contaminants due to BMPs implemented in developed areas is extremely difficult due to several factors including: (1) the high natural degree of variability in the contaminant concentrations in urban runoff, and (2) the predominant use of source control BMPs in developed areas (such as public education) the effectiveness of which is not directly measurable.
- B. Ability to measure reductions in developing areas. The preferred BMP in developing areas is the dry detention basin. These basins will primarily remove sediment and the metals and other compounds adsorbed onto the sediment. In Sacramento County, these basins are in the planning stage and the actual pollutant reduction is currently unknown.
- C. This fall, the Sacramento Stormwater NPDES Annual Monitoring Report will contain a comprehensive analysis of the three years' of data in terms of its application to the BMPs being developed.

5. Eliminating Combined Sewer Overflows from the City of Sacramento

*Rationale--*The City of Sacramento is in the process of responding to a Cease and Desist Order (CDO) issued by the Regional Board that required the prevention of combined sewer overflows (CSOs) to the Sacramento River. The Regional Board revised the CDO on October 22, 1992 allowing the City to conduct a public Health Risk Assessment of outflows from the sewer system. This risk assessment has the primary goal of reducing outflows to City streets from the combined sewer system. The impact of the project on overflows to the Sacramento River will be defined within the next two years. Water quality monitoring is also a part of the project. The alternatives to consider include no action if no significant quality impacts are found, reduction of CSOs to comply with the national CSO strategy (recently released) or total elimination of CSOs by completely separating the City's sanitary and storm drainage sewers.

*Contaminant Source--*Wastewater discharge.

Contaminants of Concern--Microbiological contaminants, TDS, DBP precursors, UV₂₅₄, nutrients, and arsenic.

Existing Monitoring Programs--

- A. CSO Sampling Program.

Desired Monitoring Locations--

- A. Sacramento River at Verona.
- B. Sacramento River upstream of the CSO discharge locations.
- C. CSO discharge locations: Pioneer Reservoir, City of Sacramento Sump 2, and City of Sacramento Combined Wastewater Treatment Plant.
- D. Sacramento River downstream of the CSO discharge locations.
- E. Sacramento River at Greene's Landing.

Related Issues--

- A. CSO discharges occur during periods of heavy rainfall when the Sacramento Combined Sewer System is unable to treat all of the combined wastewater and stormwater at the SRWTP. Flows in the Sacramento River are typically, although not always, high during these events.

OTHER MANAGEMENT ALTERNATIVES CONSIDERED

1. Rerouting Delta Agricultural Drainage.

Rationale--Improvements in drinking water quality upstream of the Delta may have little impact on drinking water quality exported from the Delta due to the impacts of Delta agricultural drainage and seawater intrusion. The impact of diverting Delta island drainage (all or some) to a point in San Francisco Bay was evaluated in 1989 in the Delta Drinking Water Quality Study. The project team recommended reevaluating this alternative in light of the extensive information that has been gathered on Delta agricultural drainage and seawater intrusion since 1989.

The Municipal Water Quality Investigations Program (MWQI) which was formerly the Delta Islands Drainage Investigation and Interagency Delta Health Aspects Monitoring Program, has an extensive database on the water quality of the Delta channels, export pumping plant intakes, and drain water discharged from Delta islands. Monitoring continues to show high Total Trihalomethane Formation Potential (TTHMFP) concentrations and high dissolved organic carbon (DOC) levels in local island drainages,

especially from peat islands. Comparisons of water quality at upstream stations such as the American River and Greene's Landing to stations in the central and southern Delta such as those along Old River, show progressive increases in TTHMFP and DOC as water moves south into the interior Delta. Based on old drainage volume estimates (1954-55), Delta island drainage would be a major source of precursors of TTHMFP and likely other DBPs. New monitoring data confirm earlier preliminary findings that drainage has detrimental impacts on the types of water treatment necessary to make water taken from the Delta safe. The MWQI Program also has synoptic monitoring data that tracks the input of bromide into the Delta and transport into the State Water Project and Central Valley Project.

The consensus of the PAC was that rerouting the Delta agricultural drainage will not be considered as an alternative but the project team will qualitatively evaluate the effect of removing agricultural drainage from the Delta and then look at the other alternatives in terms of their effect on drinking water quality with the Delta agricultural drainage removed and without it removed.

Contaminant Source--Delta island drainage and seawater intrusion.

Contaminants of Concern--DBP precursors (high in humics), TOC/DOC, UV₂₅₄, bromide, nutrients, TDS, sodium, microbiological contaminants, agricultural chemicals, and arsenic. Agricultural chemicals refer to herbicides, insecticides, fungicides, and their residue byproducts.

Existing Monitoring Programs--

- A. The MWQI Program monitors over 40 channel stations and more than 30 drain pumping plant stations. The program includes estimates of drainage volume, tidal variation studies, and a study of daily variations at a drain site.

Desired Monitoring Locations--

- A. Sacramento River at Greene's Landing.
- B. Delta Island drains.
- C. Delta channels.
- D. San Joaquin River at Vernalis.
- E. Banks Pumping Plant.

Related Issues--

- A. Drainage volume data is key to assessing the impact of drainage on Delta water TTHMFP, DOC, and other constituents in relation to other sources. DWR's plans to obtain additional flow information and alternative approaches to estimating

drainages need to be considered. Educated guesses about unsampled drains and islands may be necessary.

- B. Best Management Practices. If there are studies planned or underway to see what farming operations (e.g., winter flooding of fields) or schedules could be modified to reduce TTHMFP and DOC in drainage discharges, they should be considered.
- C. Delta Wetlands. There is a question as to whether the alternative to reroute drain water should include the removal of water created from wetland projects. If so, information on these types of projects from the proposed Delta Wetlands Project and other studies (if any) should be considered.

2. San Joaquin River Alternatives.

The PAC members discussed several potential alternatives in the San Joaquin basin, including desalting the San Joaquin River, desalting agricultural drainage from Mud and Salt sloughs, holding agricultural drainage under ground and releasing it during high river flows, and land retirement in the San Joaquin Valley and the Delta. The consensus of the PAC was to have the study team evaluate the San Joaquin River in a manner similar to the evaluation of mine drainage. This will be done by summarizing information on what has been done to eliminate agricultural drainage and perhaps estimate the effect of removing Mud and Salt slough drainage from the San Joaquin basin.

3. Delta Tributary Streams.

The management of Delta tributary streams (Consumnes, Calaveras, and Mokelumne rivers) and their drainage was identified in the Invitation for Proposal. The PAC members agreed that the effects of urbanization and increased economic activity in those watersheds to the year 2020 would be examined on a gross population and unit basis.

CONTAMINANTS OF CONCERN, CONTAMINANT SOURCES, AND BENCHMARK LOCATIONS

The contaminants of concern, contaminant sources, and source water benchmark locations were reviewed with the PAC members at the July 14, 1993 meeting. The contaminants of concern are shown in Table 1. Pesticides/herbicides were added to the original list contained in the scope of work due to the more recent USGS work. The contaminant sources, shown in Table 2, remain unchanged from the original list with the exception that agricultural drainage and sea water intrusion will not be considered as sources that could be eliminated. Table 3 presents the source water benchmark locations. The North Bay Aqueduct pumping plant was added for the alternatives that may affect North Bay Aqueduct water quality.

Table 1. Contaminants of Concern

1. Disinfection by-product precursors, surrogates, and control parameters

THMFP and TFPC (THM formation potential carbon)
Organic carbon (total (TOC) and dissolved (DOC))
Humic and fulvic acids
UV 254
Bromide
Chlorophyll *a* or pheophytin
pH and alkalinity

2. Microbiological contaminants

Coliforms
Giardia
Cryptosporidium
Viruses
Turbidity (interferes with microbiological tests)

3. Nutrients

Ammonia
Nitrate
Phosphorus

4. Arsenic

5. Total dissolved solids

6. Pesticides/herbicides

Table 2. Contaminant Sources

1. Wastewater discharges
2. Agricultural drainage upstream of the Delta
3. Urban runoff
4. Delta tributary streams and their drainage
5. Mine drainage

Note: Delta agricultural drainage and sea water intrusion will be discussed in the report but will not be considered as contaminant sources that could be eliminated.

Table 3. Source Water Benchmark Locations

1. Clifton Court (Banks Pumping Plant)
2. Tracy Pumping Plant
3. Sacramento River at Greene's Landing
4. Sacramento River at Verona
5. San Joaquin River at Vernalis
6. North Bay Aqueduct